MARAIS DES CYGNES RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Pomona Lake
Water Quality Impairment: Eutrophication

Subbasin: Upper Marais des Cygnes

Counties: Osage, Wabaunsee, and Lyon

HUC 8: 10290101

HUC 11 (HUC 14)**:** **030** (010, 020, 030, 040, 050, 060, 070, 080)

Drainage Area: Approximately 319.0 square miles.

Conservation Pool: Area = 4,131 acres, Maximum Depth = 15 meters

Designated Uses: Primary and Secondary Contact Recreation; Expected Aquatic Life Support; Drinking Water; Industrial Water Supply Use; Food Procurement

1998 303d Listing: Table 4 - Water Quality Limited Lakes

Impaired Use: All uses are impaired to a degree by eutrophication

Water Quality Standard: Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

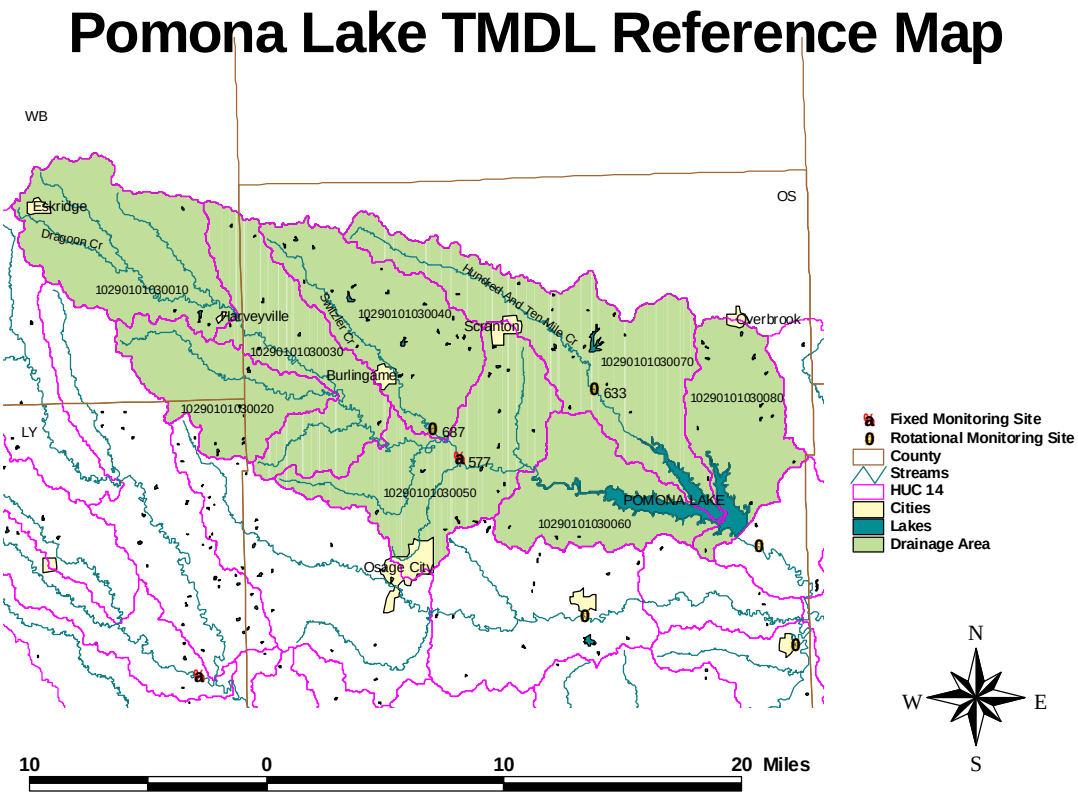
The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Argiliotrophic, Trophic State Index = 46.65

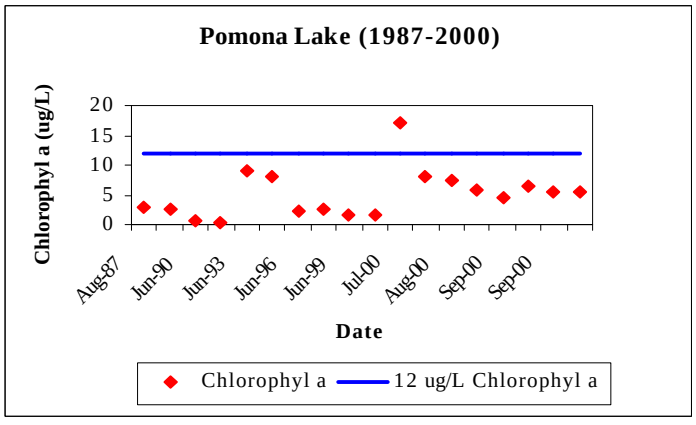
Monitoring Sites: Station 028001 in Pomona Lake (Figure 1).

Figure 1



Period of Record Used: Nine surveys during 1987 - 2000.
Kansas Biological Survey (1999 & 2000)

Figure 2



Current Condition: Pomona Lake has chlorophyll a concentrations averaging 5.15 ppb (Figure 2). This relates to a Trophic State Index of 46.65. Sampling done by KDHE shows elevated total phosphorus concentrations (averaging 101.1 ppb). Seventy-five percent of the samples are over 50 ppb (Figure 3). Light is indicated to be the primary limiting factor. Surface water in Pomona Lake has high turbidity, dominated by inorganic materials because the lake receives a steady

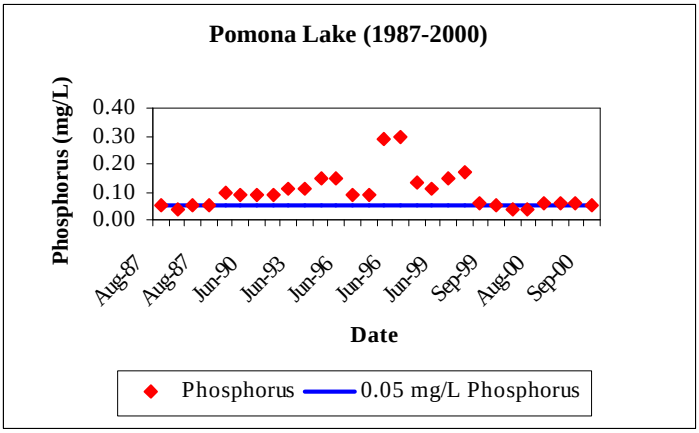
inflow of silt. Phosphorus limitation would be likely if the light limitation were removed. The chlorophyl a to total phosphorus yield is low; the algal production is reduced because light can not penetrate through the turbid water.

There is an accompanying TMDL for sediment in Pomona Lake. The chlorophyl a levels will rise when the turbidity is controlled, if current phosphorus levels in the lake are not reduced simultaneously. Assessment of eutrophication impairment based on modeling rather than direct measurement.

The Trophic State Index is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 7 ug/l and hypereutrophy occurs at levels over 30 ug/l. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

1. Oligotrophic TSI < 40
2. Mesotrophic TSI: 40 - 49.99
3. Slightly Eutrophic TSI: 50 - 54.99
4. Fully Eutrophic TSI: 55 - 59.99
5. Very Eutrophic TSI: 60 - 63.99
6. Hypereutrophic TSI: $ 64

Figure 3



In 1999 and 2000, the Kansas Biological Survey collected data monthly at various stations in Pomona Lake. A summary of those results is included in the below table.

Location	Total Phosphorus (ug/L)	Total Nitrogen (mg/L)	Chlorophyl a (ug/L)
Near Dam	**62.36**	**0.70**	**8.1**
Main Basin	**62.62**	**0.72**	**8.4**
Dragoon Ck. Arm	**102.00**	**0.86**	**14.1**
110 Mile Ck. Arm	**78.59**	**0.79**	**13.8**
Valley Brook Ck. Arm	**62.66**	**0.71**	**10.2**

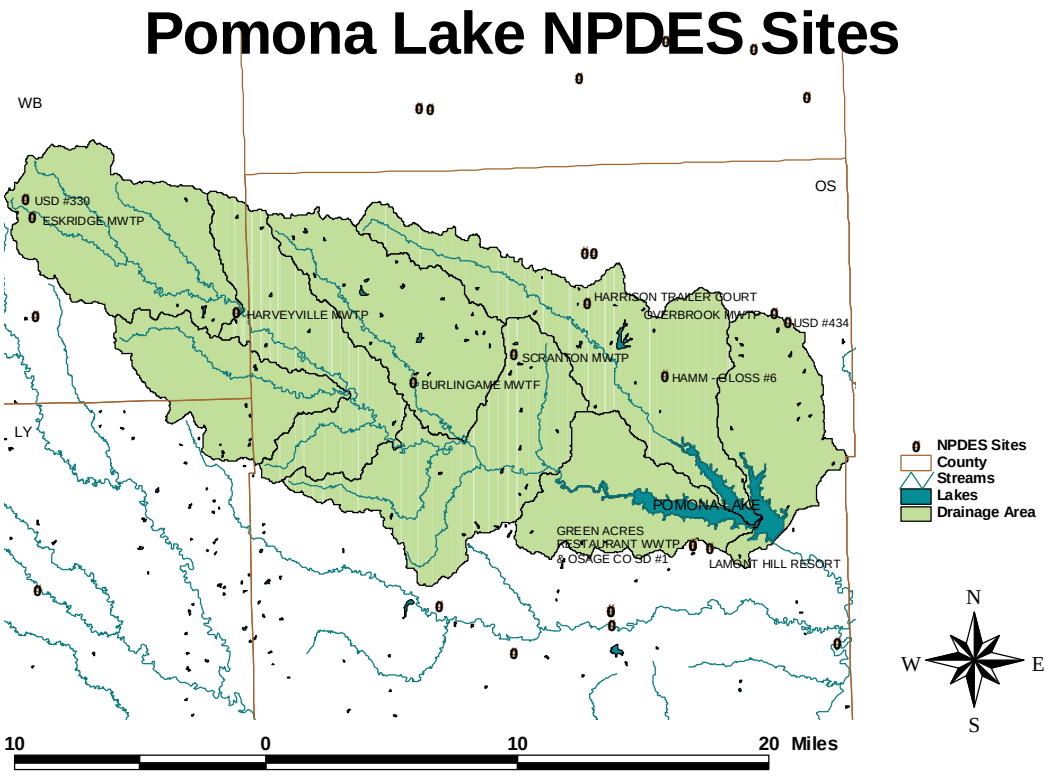
From this data, it appears that the majority of the nutrient load is coming from the Dragoon Creek subwatershed. The One Hundred Ten Mile subwatershed is contributing an intermediate amount to the total, nutrient load.

Interim Endpoints of Water Quality (Implied Load Capacity) at Pomona Lake over 2005 - 2009:
The desired endpoint will be to maintain summer chlorophyll a concentrations at or below 12 ug/l. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

3. SOURCE INVENTORY AND ASSESSMENT

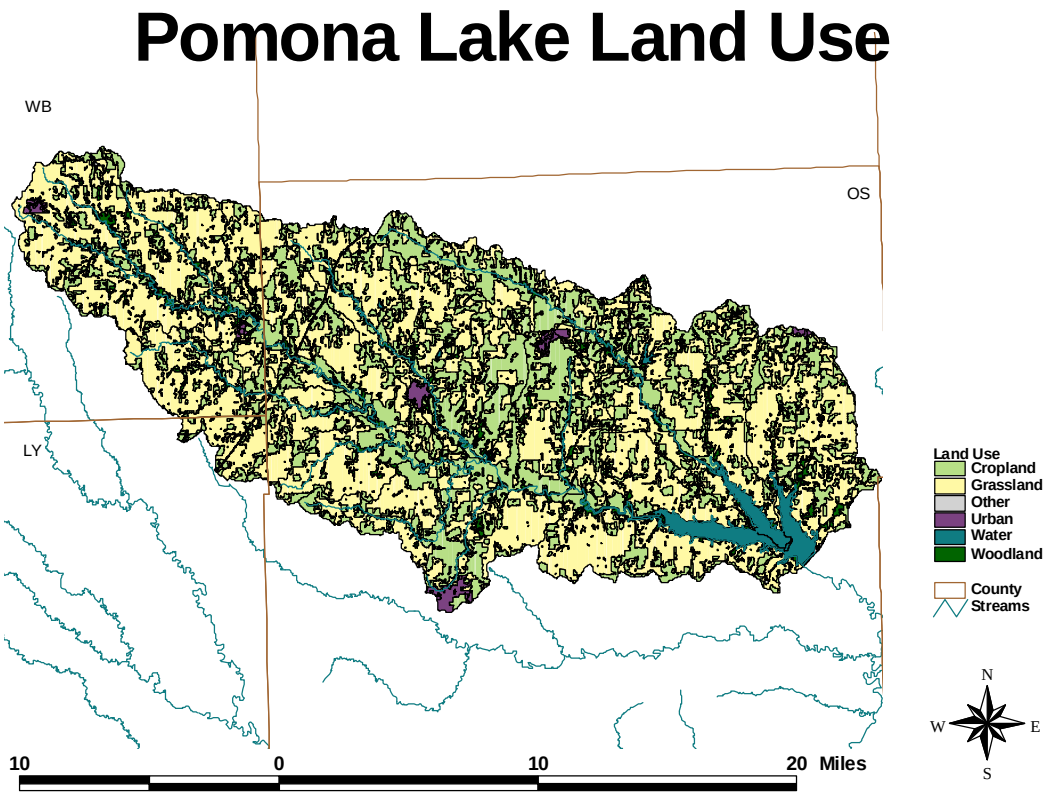
NPDES: Twelve NPDES permitted facilities are located within the watershed (Figure 4). All have waste stabilization ponds. According to projections of future water use and resulting wastewater, Burlingame MWTF does not look to have sufficient treatment capacity available. Given the limited design flow of this lagoon system, this municipal point source may impact the watershed in the future. These point sources contribute an estimated 0.52% of total annual phosphorus loads.

Figure 4



Name	Type	Design Flow (MGD)	Expiration Date
Harrison Trailer Court WTF	2-cell lagoon	Non-discharging	1998
USD #330 Mission Valley High School WTP	2-cell lagoon	Non-discharging	2002
Burlingame MWTF	3-cell lagoon	0.1210	2004
Eskridge MWTP	3-cell lagoon	0.0815	2004
Harveyville MWTP	2-cell lagoon	0.0240	2004
Scranton MWTP	4-cell lagoon	0.0800	2004
Green Acres Restaurant WWTP	2-cell lagoon	Non-discharging	2001
Lamont Hill Resort (Motel Trailer Court)	2-cell lagoon	Non-discharging	2005
USD # 434 Santa Fe Trail School	2-cell lagoon	Non-discharging	2005
Overbrook MWTP	4-cell lagoon	0.1280	2004
Osage Co. SD # 1	2-cell lagoon	Non-discharging	2005
Lamont Hill Resort WWTF	2-cell lagoon	Non-discharging	2001

Figure 5



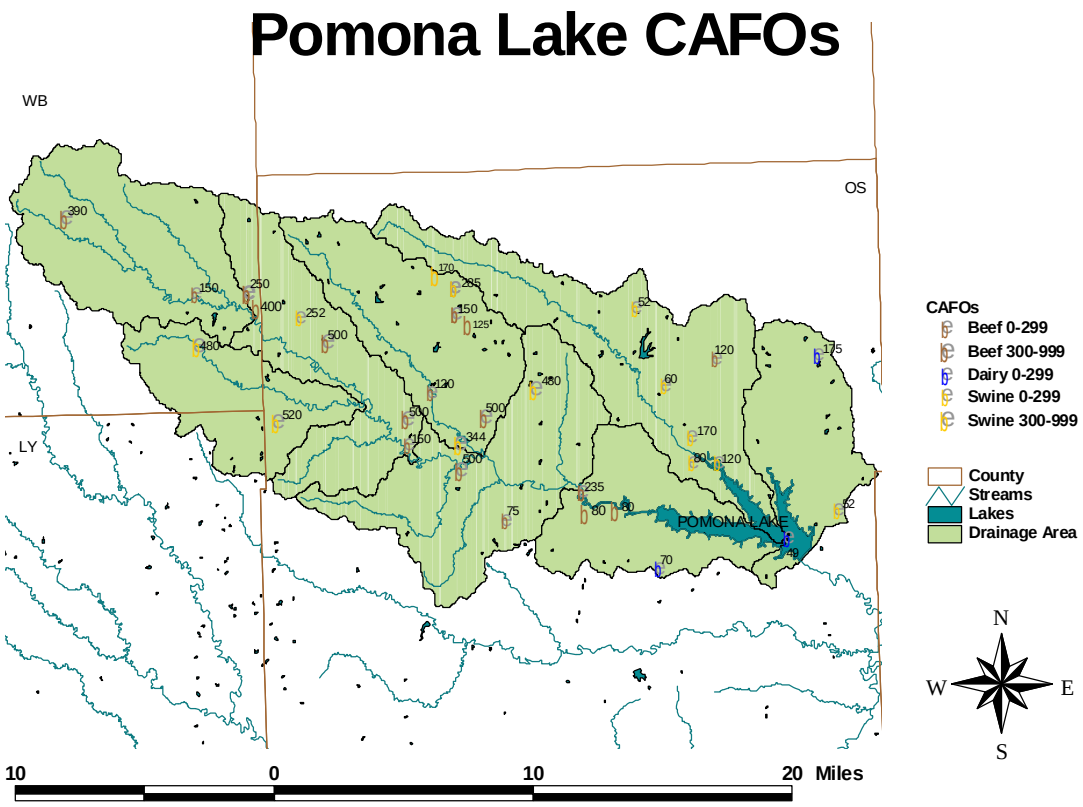
The cities within the watershed, except Harveyville, anticipate population growth between 2000 and 2020. The following population increases are expected:

Burlingame	+ 7.3%
Eskridge	+ 11.0 %
Harveyville	- 4.6 %
Osage City	+ 14.0 %
Overbrook	+ 30.5 %
Scranton	+ 7.4 %

Land Use: The watershed around Pomona Lake has a high potential for nonpoint source pollutants. An annual phosphorus load of 786,414 pounds per year is necessary to correspond to the concentrations seen in the lake.

One source of phosphorus within Pomona Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 35.4% of the watershed is cropland (Figure 5). In 1999, the total amount of fertilizer sold in Osage County was 10,190 tons. Assuming that the drainage area of Pomona Lake covers 34.9% of the county, then 3,557 tons of fertilizer were bought and potentially used with the watershed.

Figure 6



Phosphorus from animal waste is a contributing factor. Fifty-seven percent of land around the lake is grassland; the grazing density of livestock is low. Animal waste, from confined animal feeding operations, adds to the nitrogen and phosphorus load going into Pomona Lake (Figure 6). There are 3 dairy, 17 beef, 12 swine, and 1 beef/swine animal feeding operations in the watershed. Potential animal units for all facilities in the watershed total 7,684. The actual number of animal units on site is variable, but typically less than potential numbers.

A potential pollutant is septic systems located around the lake. The largest towns in the watershed are Burlingame, Osage City, and Overbrook. One percent of the watershed is urban; stormwater runoff and urban fertilizer applications are a minor contributing factor.

Contributing Runoff: The watershed's average soil permeability is 0.5 inches/hour according to NRCS STATSGO database. About 99% of the watershed produces runoff even under relatively low (1.5''/hr) potential runoff conditions. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.5"/hr of rain will generate runoff from only 79.0% of this watershed, chiefly along the stream channels.

Background Levels: Four percent of land in the watershed is woodland; leaf litter may be contributing to the nutrient loading. The atmospheric phosphorus and geological formations (i.e. soil and bedrock) may contribute to phosphorus loads. Carp may cause some resuspension of sediment.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

Phosphorus is the limiting nutrient in Pomona Lake and allocated under this TMDL. More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

Point Sources: This impairment is partially associated with municipal waste treatment plants. Ongoing inspections and monitoring of these NPDES sites will be made to ascertain the contributions that have been made by these sources. The Wasteload Allocation should be at 1,385 pounds of total phosphorus per year, a decrease of 62.4% which should also result in a decrease in available phosphorus.

Nonpoint Sources: Water quality violations are predominantly due to nonpoint source pollutants. Background levels may be attributed to leaf litter and geological sources. The assessment suggests that cropland and animal waste contribute to the elevated total phosphorus concentrations in the lake. Generally a Load Allocation of 264,983 pounds of total phosphorus per year, leading to a 62.4% reduction, is necessary to reach the endpoint.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 29,597 pounds per year of total phosphorus taken from the load capacity subtracted to compensate for the lack of knowledge about the relationship between the allocated loadings and the resulting water quality.

State Water Plan Implementation Priority: Because Pomona Lake is a federal reservoir with a large regional benefit for recreation and water supply, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Upper Marais des Cygnes (HUC 8: 10290101) with a priority ranking of 5 (High Priority for restoration).

Priority HUC 11s: The watershed is within HUC 11 (030). The Dragoon Creek subwatershed should take priority. Secondary focus should be placed the One Hundred Ten Mile subwatershed.

5. IMPLEMENTATION

Desired Implementation Activities

There is a very good potential that agricultural best management practices will allow full use support to take place in Pomona Lake. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

Implementation Programs Guidance

NPDES-KDHE

a. Begin to evaluate nutrient loading from municipal dischargers in the watershed.
b. Work with those dischargers on reducing their individual loadings.

Nonpoint Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
c. Provide technical assistance on nutrient management in vicinity of streams.

Water Resource Cost Share Nonpoint Source Pollution Control Program - SCC

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

b. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

Riparian Protection Program - SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects.
c. Promote wetland construction to assimilate nutrient loadings.

Buffer Initiative Program - SCC

a. Install grass buffer strips near streams.
b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

a. Educate agricultural producers on sediment, nutrient, and pasture management.
b. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
c. Provide technical assistance on livestock waste management systems and nutrient management plans.
d. Provide technical assistance on buffer strip design and minimizing cropland runoff.
e. Encourage annual soil testing to determine capacity of field to hold phosphorus.

Time Frame for Implementation: Pollutant reduction practices should be installed within the priority subwatersheds during the years 2002-2006, with minor follow up implementation, including other subwatersheds over 2006-2010.

Targeted Participants: Primary participants for implementation will be agricultural producers within the drainage of the lake. Initial work in 2006 should include local assessments by conservation district personnel and county extension agents to locate within the lake drainage:

1. Total row crop acreage
2. Cultivation alongside lake
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications

Milestone for 2006: The year 2006 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Pomona Lake should indicate evidence of reduced phosphorus levels in the conservation pool elevations relative to the conditions seen over 1987-2000.

Delivery Agents: The primary delivery agents for program participation will be conservation districts for programs of the State Conservation Commission and the Natural Resources

Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan.*

6. The *Kansas Water Plan* and the Marais des Cygnes Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a High Priority consideration.

Effectiveness: Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming within the watersheds cited in this TMDL.

6. MONITORING

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2005. Further sampling and evaluation should occur once before 2005 and twice between 2005 and 2009.

7. FEEDBACK

Public Meeting: The public meeting to discuss TMDLs in the Marais des Cygnes Basin was held February 28, 2001 in Ottawa. An active Internet Web site was established at http://www.kdhe.state.ks.us/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Marais des Cygnes Basin.

Public Hearings: Public Hearings on the TMDLs of the Marais des Cygnes Basin were held in Fort Scott on May 30 and Ottawa on May 31, 2001.

Basin Advisory Committee: The Marais des Cygnes Basin Advisory Committee met to discuss the TMDLs in the basin on October 4, 2000, February 28 and May 30, 2001.

Milestone Evaluation: In 2006, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Pomona Lake.
Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303d Delisting: The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2002-2006.

Bibliography

Carney, C. Edward 1999, *Requested information on the two TMDL "review themes" you received from EPA which relate to lakes* [Memorandum] 5 Aug. 1999

Liscek, Bonnie C. 2001, *Reference for Determining Limitation/Co-Limitation of Nutrients* [Memorandum] 18 Jun. 2001

Stiles, Thomas C. 1999, *Rationale and Reference to Selected TMDL Issues* [Memorandum] 6 Aug. 1999